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**Developmental Structure of Personality and Interests: A 4-wave, 8-year Longitudinal  
Study**

*Journal of Personality & Social Psychology (in press)*

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### Abstract

Personality traits and vocational interests capture different aspects of human individuality that intersect in certain ways. In this longitudinal study, we examined developmental relations between the Big Five traits and RIASEC interests over four time points from late adolescence to young adulthood (age 16 - 24) in a sample of Icelandic youth ( $N = 485$ ) well-representative of the total student population. Results showed that interests and personality traits were similarly stable over time, but showed different patterns of mean-level change. There was evidence of personality maturation but a lack of cumulative changes in interest levels. For the most part, gender differences in developmental trends were minimal. In addition, latent growth curve analyses revealed broad and specific correlated changes between personality and interests. Changes in general factors of personality and interests were moderately related ( $r = .32$ ), but stronger correlated changes were found among specific personality-interest pairs that share situational content. Overall, results reveal how interests and personality are related across different types of continuity and change. While there was little correspondence between group-level changes, substantial correlated change occurred at the individual-level. This means that when a person's personality changes, their interests tend to change in predictable ways (and vice versa). Integrative theories that link different aspects of psychological functioning can benefit by incorporating these findings.

Keywords: personality and interest development; continuity and change; correlated change; gender differences; longitudinal

## **Developmental Structure of Personality and Interests: A 4-wave, 8-year Longitudinal Study**

Individuals differ in their personality and interests with substantial consequences for major life outcomes (Nye, Su, Rounds, & Drasgow, 2012; 2017; Ozer & Benet-Martínez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Stoll et al., 2017). Vocational interests refer to enduring preferences for what people like to do, and personality traits refer to how people think, feel, and behave across situations (McCrae & Costa, 2008; Rounds & Su, 2014). Both aspects of psychological functioning have been the focus of considerable developmental research that documents changes in mean-levels and retest stability over time (e.g., Hoff, Briley, Wee, & Rounds, 2018; Low, Yoon, Roberts, & Rounds, 2005; Roberts & DelVecchio, 2000; Roberts, Walton, & Viechtbauer, 2006). Yet, few longitudinal studies have examined interests and personality traits together. Little is known about developmental relations between interests and personality, and how they change together over time.

The current study addresses this gap by examining continuity and change in interests and personality from late adolescence (age 16) to young adulthood (age 24) in an Icelandic sample. Using four waves of longitudinal data collected over an eight-year period, we analyze continuity and change in three ways. First, we compare the rank-order stability of RIASEC vocational interests (Holland, 1997) to the Big Five personality traits. Next, we compare patterns of mean-level change and examine gender differences in developmental trends. Third, we use a series of latent growth curve models to estimate intercorrelations between personality and interests in terms of levels and slopes, that is, correlated change. These models examine the extent to which personality and interest dimensions are related *within* and *between* individuals over time (Allemand & Martin, 2017). By taking an integrative perspective, our study describes the

developmental structure of two important domains of human individuality (Lubinski, 2000; Sackett, Lievens, Van Iddekinge, Kuncel, 2017).

### **Empirical and Theoretical Relations between Interests and Personality**

Previous studies on the relation between vocational interests and personality have primarily focused on cross-sectional correlations among Holland's (1997) RIASEC categories and the Big Five traits. Three meta-analyses on this topic led to similar conclusions (Barrick, Mount, & Gupta, 2003; Larson, Rottinghaus, & Borgen, 2002; Mount, Barrick, Scullen, & Rounds, 2005). In all three meta-analyses, 4 of the 30 possible personality-interest pairs had robust, positive correlations (with  $r$ 's exceeding .25): extraversion-social, extraversion-enterprising, openness-artistic, and openness-investigative. Conscientiousness also showed moderate, positive correlations with conventional interests ( $r = .19$  in Barrick et al., 2003 and in Mount et al., 2005;  $r = .25$  in Larson et al., 2002). In contrast, agreeableness and emotional stability were generally not strongly correlated with RIASEC interest dimensions. Overall, these findings suggest that three of the Big Five traits are associated with vocational interests in cross-sectional studies of college students and adults.

Beyond cross-sectional associations, it is also important to consider developmental relations between interests and personality. Several influential theories have argued that interests and personality traits change together over the course of development (e.g., Ackerman, 1996; Corno, Cronbach et al., 2002; Hogan, 1983; Kandler, Zimmermann, & McAdams, 2014; Roberts & Wood, 2006; Schmidt, 2014; Snow, Corno, & Jackson, 1996; Wrzus & Roberts, 2016). Although these integrative theories differ in their focus, they all predict some degree of *correlated change* between interests and personality. Correlated change refers to similarity in how individuals change in different attributes. Positive correlated change between a personality

trait (e.g., extraversion) and interest category (e.g., enterprising) indicates that individuals tend to change in the same direction in these two domains, while negative correlated change indicates that changes occur in the opposite direction. The magnitude and direction of correlated change between different pairs of interests and personality traits depends on the extent to which they are affected by similar developmental processes (Allemand & Martin, 2017).

Wrzus and Roberts' (2016) theoretical model of developmental processes (TESSERA; Triggering situations, Expectancy, States/State expressions, and Reactions) specifically addresses the issue of correlated change between personality and motivational variables (including interests). According to the model, triggering situations are the key link between personality and interest development. Triggering situations may include daily events, repeated experiences in certain contexts, or major life transitions. The assumption is that situations that repeatedly trigger changes in states lead to long-term changes in traits that share those situations. For example, if a person recurrently experiences enjoyment from engaging in leadership roles, they may gradually become more extraverted over time while also becoming more interested in leadership activities (i.e., enterprising interests). On the other hand, if a person experiences neutral or negative emotion while engaged as a leader, their extraversion and enterprising interest levels will likely remain unchanged or decrease over time.

Importantly, triggering situations are only expected to produce correlated changes in personality and interest dimensions that share common situations or activities. Table 1 provides an overview of the six RIASEC interest categories and their shared situations with Big Five traits. Most interest categories share common activities and/or environments with at least one personality trait. For example, investigative and artistic interests are similar to openness in that they involve an appreciation for the arts and science. Social and enterprising interests are similar

to extraversion in that they capture situations with a high degree of interpersonal interaction. Conventional interests and conscientiousness both involve structured routines and work environments.

To the extent that correlated change is found, causal processes associated with common situations are likely shared between the relevant interest and personality dimensions (Wrzus & Roberts, 2016). These causal processes could reflect common situational effects (i.e., experiencing enjoyment during social interactions increases both extraversion and enterprising interests), situation selection (i.e., either extraversion, enterprising interests, or other personal factors influence the types of situations a person seeks out), or directional effects across domains (i.e., increasing extraversion causes increases in enterprising interests, or vice versa). Of course, certain interest categories and personality traits do not share common situations. Realistic interests that involve working with hands, tools, and machines have little in common with any of the Big Five traits. Emotional stability and agreeableness capture broad behavioral tendencies that cut across many contexts, but do not overlap considerably with any single interest category. In these dimensions, we would expect relatively low correlated change.

[INSERT TABLE 1 HERE]

Studying correlated changes between interests and personality offers a unique perspective into how people change in terms of what they like to do and how they think and behave across situations. Both aspects of psychological functioning are highly stable over time (Low et al., 2005; Roberts & DelVecchio, 2000), but represent distinct aspects of human individuality. Two large-scale longitudinal studies showed that interests and personality traits measured at the end of secondary school contribute unique variance in predicting career and life outcomes ten years later (Stoll et al., 2017; Su, 2012). These findings highlight the importance of studying how



interests and personality traits develop and change—both separately and in relation to each other—during the formative years of adolescence and young adulthood.

### **Previous Research on Interest and Personality Development**

Most longitudinal research on interest and personality development has focused on rank-order stability and mean-level change. Meta-analyses have summarized longitudinal studies in each area to reveal how groups of people change and remain the same in their interests and personality over time (Hoff et al., 2018; Low et al., 2005; Roberts et al., 2006; Roberts & DeVecchio, 2000). However, only tentative comparisons can be made across domains because the meta-analyses on interests and personality traits were based on different samples. Few studies have measured both constructs longitudinally, resulting in a lack of knowledge about how interests and personality develop in relation to each other. Next, we summarize existing research on rank-order stability, mean-level change, and correlated change while pointing out limitations that we aim to address in the current study.

**Rank-order stability.** Rank-order stability captures the extent to which the relative ranking of individuals within a group remains the same over time (when individuals are “rank-ordered” in terms of their interest or personality levels). Meta-analyses have summarized studies on the rank-order stability of interests (Low et al., 2005) and personality traits (Roberts & DeVecchio, 2000). Both meta-analyses found that stability generally increases throughout adolescence and young adulthood. This finding has been labelled the *cumulative continuity principle*. For both interests and personality traits, the relative ranking of individuals within a group becomes increasingly stable with age (Roberts & Mroczek, 2008). From the TESSERA framework, cumulative continuity can be explained as resulting from increasingly stable

environments and self-selected experiences that stabilize personality traits with age (Roberts & Caspi, 2003; Wrzus & Roberts, 2016).

The comparative stability between interests and personality traits is less clear. Low et al. (2005) compared meta-analytic stability estimates for vocational interests to personality traits using data from Roberts and DelVecchio (2000). Results indicated that interests were more stable throughout adolescence and young adulthood. This finding suggests that vocational interests may stabilize before personality, contrary to certain assumptions from personality theories (McCrae & Costa, 1999, 2008). However, it is important to note that Low et al.'s comparisons were indirect in that they were based on estimates from meta-analytic datasets containing different samples. In other words, stability levels were compared across different people at similar ages.

**Mean-level change.** Mean-level change reflects variations in a group's average trait levels over time, or how people change *on average* across the lifespan. Research on mean-level changes in personality has led to two important findings. First, mean-levels of the Big Five traits tend to increase during young adulthood, particularly conscientiousness, agreeableness, and emotional stability (Roberts et al., 2006). This finding has been labelled the *maturity principle* (Roberts & Mroczek, 2008) because it describes increases in traits associated with social maturity. Openness to experience also increases sharply during late adolescence, but plateaus during young adulthood (Roberts et al., 2006). Another major finding is that mean-level changes in personality traits are often associated with social role transitions, such as becoming more invested in work (Hudson, Roberts, & Lodi-Smith, 2012; Lodi-Smith & Roberts, 2007; Nye & Roberts, 2013). Young adulthood is defined by a variety of social role transitions that require adapting to new triggering situations where maturity is valued (e.g., graduating secondary

school, starting full-time work). These transitions help explain why most personality change occurs during young adulthood (Bleidorn, Hopwood, & Lucas, 2018; Wzrus & Roberts, 2016).

Compared to personality traits, mean-level changes in vocational interests are smaller and more gradual. Hoff et al.'s (2018) meta-analysis found that interests change differently during adolescence and young adulthood. Mean-levels of vocational interests decrease in almost every RIASEC category during early adolescence, but then recover during late adolescence. In contrast, young adulthood is marked by a gradual increase in people-oriented interests (i.e., social, enterprising, and artistic). This normative increase may reflect a maturation process similar to personality. During young adulthood, people become more socially mature in their personality, while also becoming more interested in people-oriented activities and environments. However, it is noteworthy for the present study (of Icelandic students) that Hoff et al.'s findings were based on U.S. samples only.

***Gender differences.*** Gender differences are important to consider when examining mean-level change because men and women differ in initial levels of certain interest categories and personality traits. In general, there are larger gender differences in interests compared to personality traits (Lippa, 1998, 2010; Su, Rounds, & Armstrong 2009; Su & Rounds, 2015). The largest gender differences in the Big Five personality traits are moderate in magnitude ( $d = .40$  in emotional stability;  $d = -.34$  in agreeableness; negative effect sizes indicate stronger female mean scores; Lippa, 2010). In contrast, gender differences in realistic ( $d = .84$ ) and social interests ( $d = -.64$ ) are among the largest of any psychological variable (Su et al., 2009). In Iceland, almost identical patterns of gender differences in interests have been detected compared to estimates from U.S. samples; the only exception is that Icelandic men have stronger conventional interests

compared to women (Einarsdóttir, 2001; Einarsdóttir & Rounds, 2013; Scheving-Thorsteinsson, 2009).

Longitudinal research shows that the size of certain gender differences changes with age, but only to a small extent. Hoff et al. (2018) found that gender differences in realistic and social interests increased drastically during early adolescence, then gradually declined throughout late adolescence and young adulthood. These findings suggest that early adolescence is the lifetime peak of gendered vocational interests. However, the declines in gender differences during young adulthood identified by Hoff et al. were relatively small in magnitude compared to estimates of the overall size of differences in realistic and social interests (Su et al., 2009). Thus, there are still likely to be large gender differences in vocational interests in middle and late adulthood. Similarly, research on personality has shown that the magnitude of gender differences in the Big Five traits is relatively consistent across the lifespan and in different cultures (Costa, Terracciano, & McCrae, 2001; De Bolle et al., 2015; Lippa, 2010; Roberts et al., 2006; Schmitt, Realo, Voracek, & Allik, 2008).

**Correlated changes in personality and interests.** Whereas rank-order stability and mean-level change are group-level measures, correlated change occurs at the individual-level. Previous studies have examined correlated changes within personality and interest domains, but not between (e.g., Allemand, Zimprich, & Martin, 2008; Klimstra, Bleidorn, Asendorpf, Van Aken, & Denissen, 2013; Schultz, Connolly, Garrison, Leveille, & Jackson, 2017). In a review of seven studies on correlated change within personality, Allemand and Martin (2017) concluded there is moderate correlated change between the Big Five traits, with an average change coefficient of  $\Delta r = |.25|$ . This suggests that changes in the Big Five traits co-occur to some extent. However, correlated changes appear to be stronger among certain combinations of traits.

For example, Klimstra et al. (2013) found that correlated changes are more likely to occur in Big Five traits associated with similar developmental processes, such as social investment (i.e., conscientiousness, emotional stability, and agreeableness).

A recent study by Schultz et al. (2017) examined correlated changes between RIASEC interests in a sample of 442 adults across two waves of measurement over a 20-year span (from age ~25 to ~45 years). The results indicated statistically significant correlated change in 13 of 15 pairings of RIASEC categories (e.g., investigative-artistic), and effect sizes were of similar magnitude to studies conducted within personality. However, the direction of several change correlations diverged from expectations based on the relations among RIASEC categories (Holland, 1997). For example, changes in social interests were negatively correlated with changes in artistic interests, but positively correlated with changes in realistic interests. This is surprising because levels of social and artistic interests are typically positively correlated, whereas levels of social and realistic interests are either uncorrelated or negatively related (Rounds & Tracey, 1993; Tay, Su, & Rounds, 2011). It is worth noting that RIASEC scales were not directly measured in this study, and were instead computed by averaging empirically-derived occupational scales from the Strong Vocational Interest Blank (Strong, 1943).

Overall, these correlated-change studies suggest that personality and interests are shaped by specific and general developmental processes. Specific processes such as situation selection or social investment may explain why correlated changes are stronger among trait pairs that encompass similar situations (e.g., Klimstra et al., 2013). Yet there is also evidence of a general change factor that makes correlated change more likely across all trait categories, even those that contain less similar situational content (Allemand & Martin, 2017; Schultz et al., 2017). It is therefore important to consider the extent to which changes co-occur in all interest categories and

personality traits. Research on cognitive aging also supports the existence of a general change factor, as changes in different cognitive abilities are typically positively correlated with each other (e.g., Baltes & Lindenberger, 1997; Kievit et al., 2017; Tucker-Drob, Briley, Starr, & Deary, 2014). To date, however, few longitudinal studies have explicitly modeled change within general factors of interests or personality. We address this limitation in the current study by estimating correlated change among general factors, which we use as a comparison point for interpreting the strength of correlated change among specific pairs of personality traits and interests.

### **Current Study**

In this longitudinal study, we investigate three types of continuity and change in vocational interests and personality traits: rank-order stability, correlated change, and mean-level change. Our Icelandic sample is somewhat unique from the primarily North American samples included in previous meta-analyses on interest and personality development (Hoff et al., 2018; Low et al., 2005; Roberts et al., 2006, Roberts & Delvecchio, 2000). When applicable, we consider relevant aspects of the Icelandic culture and education system when discussing hypotheses and results. Nonetheless, we generally did not expect to find substantially different results due to characteristics of our sample, consistent with previous longitudinal research from other Northern European countries (e.g., Bleidorn et al., 2013; Borghuis et al., 2017; Rantanen, Metsäpelto, Feldt, Pulkkinen, & Kokko, 2007).

Our first set of analyses compare the rank-order stability of interests and personality across the four waves of measurement (from age 16 to 24). As mentioned, meta-analytic comparisons—of different people at similar ages—suggest that RIASEC interests are more stable than the Big Five traits during adolescence and young adulthood (Low et al., 2005; c.f.,

Roberts & DelVecchio, 2000). Yet both interests and personality traits become increasingly stable with age (i.e., cumulative continuity; Roberts & Caspi, 2003). We therefore proposed the following hypothesis:

*Hypothesis 1:* Vocational interests will show higher rank-order stability levels than personality traits across all four time-points.

Our second set of analyses examine mean-level change and consider gender differences in developmental trends. Based on meta-analyses of mean-level change in personality (Roberts et al., 2006) and interests (Hoff et al., 2018), we expected positive mean-level changes in some, but not all, trait categories. For personality traits and interests, respectively, we proposed the following hypotheses:

*Hypothesis 2a:* Among the Big Five, mean-levels of emotional stability, agreeableness, openness, and conscientiousness will increase from age 16 to 24.

*Hypothesis 2b:* Among RIASEC vocational interests, mean-levels of people-oriented interest categories will gradually increase over time (i.e., social, artistic, enterprising), while things-oriented interests will remain constant (i.e., realistic, investigative, conventional).

For gender differences, we expected to find mean intercept differences in Big Five traits and RIASEC categories consistent with previous research in Iceland (Einarsdóttir & Rounds, 2013). We did not expect gender differences in patterns of mean-level change (i.e., no slope differences). Although past research has shown that the size of gender differences in interests can change with age, much of this change occurs during the transition from early to late adolescence (Hoff et al., 2018), and would therefore not be captured in our study. We therefore proposed the following hypothesis:

*Hypothesis 2c:* Men and women will show similar patterns of change, but will have different levels of certain interests and personality traits. Specifically, men will score higher on emotional stability, and realistic, investigative, and conventional interests. Women will score higher on agreeableness, and social and artistic interests.

Third, we apply latent-growth curve modeling to estimate correlations between changes in personality and changes in interests (i.e., correlated change). We also estimated correlated change among general factors of interests and personality. Correlated change among general factors provides a baseline estimate of the degree to which changes co-occur in all interest and personality dimensions. Importantly, we used this estimate as a comparison point for interpreting the magnitude of change correlations between specific interests and personality traits. Based on cross-sectional relations and the degree of situational similarity in different personality and interest domains (see Table 1), we proposed the following hypothesis:

*Hypothesis 3:* The magnitude of correlated changes in five specific personality-interest pairs (extraversion-social, extraversion-enterprising, openness-artistic, openness-investigative, conscientiousness-conventional) will be stronger than correlated changes among general factors. For the other 25 specific pairings of Big Five traits and RIASEC interests, correlated changes will be of similar magnitude, or weaker than, correlated change among general factors.

Although not our primary focus, we also examined level-level and level-change correlations between RIASEC interests and the Big Five. Level-level correlations represent cross-sectional associations between interests and personality traits. We expected strong, positive level-level correlations in the same five personality-interest pairs identified above, consistent with previous meta-analyses (Barrick et al., 2003; Larson et al., 2002; Mount et al., 2005). Level-



change correlations illustrate associations between intercept values and slopes. When estimated within trait domains, level-change correlations are often negative, potentially signaling the presence of ceiling effects (Allemand, Schaffhuser, & Martin, 2015; Wille, Hofmans, Feys, & De Fruyt, 2014). This means that individuals with higher levels of a given trait show less growth in that trait over time compared to the average individual, possibly because they have less room for growth. Vocational interests and personality are both trait-like constructs, so we expected the vast majority of level-change correlations between the Big Five traits and RIASEC interests to be negative. In other words, we expected individuals with higher levels of interest or personality to show less growth in the opposite trait domain over time.

### **Method**

The study was reviewed by the Icelandic Data Protection Authority in four submissions. It was initially submitted to the Data Protection Authority on 06/10/2005 (submission number S2655: *Þróun netvæddrar áhugakönnunar fyrir grunn-og framhaldsskólanema*; “Development of an on-line interest inventory for compulsory and upper-secondary education students”). It was reviewed again on 09/03/2012 and 03/10/2014 (submission numbers S5676 and S7024 with the same title: *Þróun persónuleika, starfsáhuga og lífsmarkmiða meðal íslenskra ungmenna*; “Personality, interest and life goal development among Icelandic youth”). The use of educational testing and registration data to describe the sample was reviewed on 06/23/2011 (submission number S5238: *Spáir samræmi í starfsáhuga á námsvali fyrir um brotthvarf úr framhaldsskóla*; “Does interest major congruence predict dropout from upper secondary education?”).

### **Participants**

The participants<sup>1</sup> were 485 students born in 1990 contacted during their last year

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<sup>1</sup> The data from this study has not been used in any previous publication apart from the Icelandic Interest Inventory handbook (Einarsdóttir & Rounds, 2007; 2013).

of compulsory education in Iceland (10th grade, 47% female, average age = 15.3<sup>2</sup>). The sample is well-representative of the Icelandic student population as a whole, although students from outside the capital city (Reykjavik) are slightly overrepresented. Close to 48% of the sample reported they had grown up in the capital area, compared to 60% of the overall population in 2006 (Iceland Statistics, 2012). Information on participants' national exams scores indicates that the sample represents Icelandic students in terms of academic achievement. Exam results are reported on a standardized scale of 0 – 60 with an overall mean of 30 (SD = 10). In this sample, the means for math, Icelandic, and English were 30.1 (SD = 9.24, N = 460), 30.5 (SD = 8.95, N = 467) and 30.3 (SD = 9.29, N = 452), respectively. The scores were normally distributed with skewness of .13 for math, -.01 for Icelandic and -.10 for English.

Participants were contacted again two, six, and eight years later. At time two ( $N = 188$ , 56% female, average age = 17.7), almost 95% of respondents reported enrollment in upper secondary school, and 13% were working full-time. Participants reported a variety of educational and work-related statuses at times three and four. At time three ( $N = 237$ , 54% female, average age = 21.7), 61% were still enrolled in some form of education and 50% were working full-time. At time four ( $N = 211$ , 56% female, average age = 23.7), 57% were still enrolled in some form of education and 40% were working full-time.

## **Procedure**

The data was first collected in 2006 as a part of the standardization of the Icelandic Interest Inventory (Bendill – I, Einarsdóttir & Rounds, 2007). Forty schools were randomly chosen from a list provided by the Ministry of Education of all compulsory education schools offering 10th grade in Iceland. Administrators of 21 schools from six of the eight geographic

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<sup>2</sup> We refer to the first timepoint as age 16 throughout the paper because participants were either 16 or turned 16 during this year.

regions in Iceland accepted the request for participation. They informed parents and offered them the chance to decline participation. A contact person assigned by each school (usually the career counselor) administered the measures on-line to students in groups following a detailed procedure and with the aim of collecting data from all 10th grade students in each school. Participants were asked to provide a national identification number and were told they might be contacted later for future studies. At times two, three, and four, participants were contacted through telephone and email to be recruited for the study.

### **Measures**

**Personality.** Big Five personality traits were measured using the Icelandic version of the NEO-FFI (Costa & McCrae, 1992; Jónsson & Bergþórsson, 2004). The measure contains 60 total items, 12 for each Big Five trait (i.e., emotional stability, extraversion, openness, agreeableness, and conscientiousness). The five-factor structure of this measure has been previously validated in Icelandic samples). Participants self-reported their personality traits using five-point Likert scales. Table 2 reports the means, standard deviations, Cronbach's alpha, and Omega composite reliabilities for all personality and interest scales at each timepoint. The internal consistency reliability (alpha) of the personality scales ranged from .65 to .85 at time one, .71 to .88 at time two, .76 to .88 at time three, and from .72 to .86 at time four. We also calculated Revelle's omega total reliabilities as an alternative to Cronbach's alpha (McNeish, 2017, p. 8; Revelle, 2008; 2016). Omega total reliabilities ranged from .70 to .88 at time one, .76 to .91 at time two, .80 to .91 at time three, and .79 to .90 at time four.

[INSERT TABLE 2 HERE]

**Interests.** Vocational interests were assessed using the Icelandic Interest Inventory (I and II; Einarsdóttir & Rounds, 2007; 2013). The inventory contains 114 items designed to capture

Holland's (1997) six RIASEC categories (i.e., realistic, investigative, artistic, social, enterprising, and conventional). Each RIASEC scale contained 17 - 22 items reflecting the structure of the Icelandic labor market. Half of the items (57) refer to occupational activities (e.g. *design a computer program, assist people with disabilities, cut fish in a machine*), while the other half refer to (upper secondary) school subjects (e.g. *natural sciences, electronics, literature, use of tools*). Participants responded to items on five-point scales ranging from 1 (*strongly dislike*) to 5 (*strongly like*). A randomization test of the RIASEC correlation matrix (Rounds, Tracey, & Hubert, 1992) resulted in a CI = .69, indicating a good fit to Holland's structural model (Einarsdóttir & Rounds, 2013). Cronbach's alphas ranged from .91 to .93 at time one, .90 to .94 at time two, .91 to .95 at time three, and from .91 to .94 at time four. Revelle's omega total reliabilities ranged from .93 to .95 at time one, .93 to .95 at time two, .93 to .96 at time three, and .93 to .96 at time four.

In addition to personality and interests, the longitudinal study also included measures of life goals and self-efficacy beliefs that were not the focus of this article.

### **Missing Data**

To examine whether there was a pattern to the missing data, we first categorized participants into three groups based on whether they responded at all four timepoints (i.e., *stayers*), responded at only the first time point (i.e., *leavers*), or responded at the first timepoint and at least once more (i.e., *returners*). Among the 485 participants, 95 were stayers, 242 were leavers, and 148 were returners. We then conducted independent sample t-tests and calculated Cohen's *d* for each pair of missing groups for all measurement aspects (i.e., Big Five traits, RIASEC interest categories). Of the 33 total pairs analyzed, only three comparisons had statistically significant mean differences: stayers vs. returners in social interests (t-test  $p = .038$ ,

Cohen's  $d = -.240$ ), stayers vs. leavers in realistic interests (t-test  $p = .023$ , Cohen's  $d = .299$ ), and stayers vs. leavers in social interests (t-test  $p = .005$ , Cohen's  $d = -.354$ ). We also tested for differences between stayers, returners, and leavers across gender and home location (capital area vs. non-capital area). Chi-square tests indicated that both gender  $X^2(2, N = 485) = 19.54, p < .01$  and home location  $X^2(2, N = 485) = 8.98, p = .01$  were significant predictors of missing data groups. Women and participants from the capital area were more likely to stay in the study. Based on these results, we included gender and home location as auxiliary variables in all applicable models (Collins, Schafer, & Kam, 2001).

Full-information maximum-likelihood (FIML) technique was implemented for all analyses through the "lavaan" package in R 3.3.2 (Rosseel, 2012; R Core Team, 2013). The FIML method directly estimates parameters using all observed variables (Enders, 2001). The FIML technique is recommended for treating missing data in longitudinal modeling because it is unbiased under missing-completely-at-random (MCAR) and missing-at-random (MAR) situations and provides more efficient (e.g., smaller sampling error) parameter estimates (Newman, 2003; 2014).

## Data Analysis

**Measurement invariance.** We tested whether factor loadings and intercepts were invariant across time and gender for each personality trait and interest category following the procedure described by Widaman, Ferrer, and Conger (2010). We first created three parcels for each trait category using the item-to-construct balance technique (Little, Cunningham, Shahar, & Widaman, 2002). Next, we compared fit statistics for a series of increasingly restricted models to establish invariance across time. In the baseline model (configural invariance), the same pattern of factor loadings was specified at each timepoint. In the next two models, factor loadings

(metric invariance) and intercepts (scalar invariance) were set to be invariant across time. When scalar invariance was not supported, we tested for partial scalar invariance by freeing the intercept constraint for the parcel with the largest residual value at a single timepoint.

After establishing scalar or partial scalar invariance across time for each variable, we tested for longitudinal measurement invariance across gender using a similar model comparison approach. In the first model (configural invariance), we specified the same pattern of factor loadings for men and women. In the second and third models, we set factor loadings (metric invariance) and intercepts (scalar invariance) to be equal across gender. When longitudinal scalar invariance was not supported across gender, we established partial invariance by freeing the parcel with the largest residual value at a single timepoint for either males or females.

**Rank-order stability.** Rank-order stability was assessed from Time 1 to Time 4 and between adjacent time points (i.e., T1-T2, T2-T3, and T3-T4) using Pearson correlations. We then tested whether stability estimates differed across personality and interests. Power analyses were conducted using GPower 3.1 (Faul, Erdfelder, Lang, & Buchner, 2009) with the smallest (most conservative) sample size from the four timepoints ( $N = 188$ ). Power analyses revealed a statistical power of 99% to detect a medium correlation ( $r = .3$ ) with confidence intervals that do not include zero (Cohen, 1992).

**Mean-level change.** Mean-level change was examined through comparisons of average scale scores at each time point. The difference between two mean scores was estimated using the standardized mean difference, Cohen's  $d$ . Power analyses using the smallest sample size ( $N = 188$ ) revealed a statistical power of 78% to detect a small effect size ( $d = .2$ ) and over 99% to detect a medium effect size ( $d = .5$ ) with confidence intervals that do not include zero (Cohen, 1992).

In addition to estimating the standardized difference scores, we also conducted latent growth curve modeling to *A)* formalize the description of mean-level change through *d*-value calculations, and *B)* estimate gender differences in levels and changes in personality and interests. Specifically, for each of the Big Five traits and RIASEC vocational interests, we modeled the influence of gender on the intercept and slope variables. Gender was dummy coded with females coded as 0 and males coded as 1. The path coefficient for the link between gender and the intercept/slope variable illustrates the magnitude and direction of gender differences in the level/change of that trait category, standardized with respect to the personality or interest scale. For example, a statistically significant positive coefficient between gender and an intercept variable indicates that men have higher levels of a certain personality trait or interest compared to women.

**Correlated changes.** We used latent growth curve modeling to estimate correlated change between personality and interests. The latent growth curve model differs from traditional stability and mean-level change analyses in that it takes into account individual variances and incorporates latent variables (e.g., McArdle, 2009). We chose to use linear growth models over quadratic models because the linear models required estimating fewer parameters and afforded more power to detect correlated change with our sample size and missing data. In addition, past work on personality and interests primarily identified linear growth trends during this age period (Hoff et al., 2018; Roberts et al., 2006), with non-linear trends primarily occurring during earlier age periods (Soto & Tackett, 2015). Prior to estimating correlated change, we used growth curve modeling to check the results of mean-level change analyses based on *d*-values while taking into account individual variances. Then, parallel growth processes were modeled to examine correlated change.

First, interests and personality traits were modeled as a function of time (i.e., T1 to T4) with three types of latent variables: intercept, slope, and residuals. By doing so, the values of the intercept and slope represent levels and changes separate from random error (i.e., residuals). The intercept reflects the level of the trait at the first timepoint, whereas the slope represents the average rate of change over time. As Times 2, 3, and 4 were each separated from Time 1 by 2, 6, and 8 years, respectively, the path to Time 1 was fixed to 0; the path to Time 2 was fixed to 1 (i.e.,  $2/2$ ); the path to Time 3 was fixed to 3 (i.e.,  $6/2$ ); and the path to Time 4 was fixed to 4 (i.e.,  $8/2$ ).

[INSERT FIGURE 1 HERE]

Saturated growth curve models with all level-level, level-change, and change-change correlations were estimated separately for all 30 pairings of interests and personality traits. These models included within-wave correlations between residuals, as illustrated in Figure 1. To evaluate statistical power to detect correlated change, Monte Carlo simulations were conducted using Mplus version 8 (Muthén & Muthén, 1998-2017). We evaluated statistical power post-hoc for the five hypothesized interest-personality pairs described in Table 1. Because these power analyses were conducted post-hoc, we estimated model parameters using the actual data, then used the estimated parameters as true parameters to simulate 1,000 new datasets (e.g., Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2006). We chose to use actual data to remove uncertainty about specifying key parameters (e.g., slope variances) in the Monte Carlo simulations. Power is represented by the proportion of cases in the 1,000 simulated datasets with a statistically significant change-change correlation. The results revealed a statistical power of 53% to detect the smallest observed correlation ( $r = .20$ ) among the hypothesized pairs, and 100% power to detect the other four change-change correlations ( $r = .42$  and greater). Because



the amount of slope variance for the hypothesized pairs was not dramatically different compared to most other analyzed traits, these power estimates should be generally representative of the other correlated change effect sizes. Overall, these results indicate sufficient statistical power for the purpose of our correlated change analyses.

We also estimated correlated change among general factors of personality and interests, which was used as the primary comparison point for interpreting the magnitude of correlations among specific personality traits and interests. Little empirical data is available to guide our expectations for the magnitude of change-change associations for personality and interests. To provide some grounding, we tested the extent to which abstract, general sources of variance in personality and interest were correlated. Put differently, we were less interested in testing whether change-change associations were different from zero, and instead, we estimated a relevant effect size of broad interest and personality change for comparison purposes. Figure 2 displays the path diagram for the general factor model of personality estimated from the growth curves for each Big Five personality trait. We estimated a general factor of levels using the level of each trait as indicators, and we estimated a general factor of change using the slope of each trait as indicators. Although not pictured in Figure 2, the same higher-order model structure was used to estimate the general factor of interests. We chose to model general factors using a higher-order approach because it enabled us to identify the amount of variability in levels and change shared across personality traits or interest categories. The general factors capture differing amounts of variance in specific traits primarily because traits vary in the extent to which they are correlated with each other.

The general factor of personality accounted for most of the variance in levels and changes in extraversion and conscientiousness, and to lesser extents, agreeableness and emotional

stability. For levels of personality traits, estimates of variance accounted for ranged from 14% for agreeableness to 69% for extraversion, with an average of 38%. For changes, variance accounted for ranged from 19% for agreeableness to 100% for extraversion, with an average of 52%. The general interest factor accounted for between 13% (for social) and 100% (for enterprising and conventional) of the variance in levels of RIASEC categories, with an average of 55%. For changes in interests, the general factor accounted for between 30% (for social) and 100% (for enterprising and conventional) of the variance in slopes, with an average of 77%.

The general factor personality model fit well (RMSEA = .06; CFI = .87), whereas the general interest factor model fit the data poorly (RMSEA = .12; CFI = .64). Although the fit of general factor models was not central to our analyses, we performed additional sensitivity analyses and tested alternative models to ensure the robustness of our results. We examined various models by modifying the variances of intercepts and slopes estimated for RIASEC dimensions. We eventually retained the full model for subsequent analyses because there was no evidence that the alternative models exhibited better model fit, and none of these submodels altered our interpretations.

The overall fit indices reported for evaluating the latent growth curve models are  $\chi^2$ , RMSEA, CFI, SRMR, and TLI.  $\chi^2$  statistic is often referred to as indicator of “lack of fit” (Mulaik et al., 1989) and is related to degrees of freedom. Some have suggested that a model with an RMSEA below .05 has “good” fit, and an RMSEA below .08 has “acceptable” fit (McDonald & Ho, 2002). Generally, a model is regarded as acceptable when CFI values are greater than .90 (e.g., Hu & Bentler, 1999). For all sets of analyses, we report standard errors or 95% confidence intervals around effect sizes as an indicator of precision. Tables S5-S7 in the

supplemental materials report correlation matrices for all personality and interest variables at each timepoint.

## Results

### Measurement Invariance

We tested for measurement invariance across time using the procedure outlined by Widaman, Ferrer, and Conger (2010). Fit statistics for the invariance models across timepoints are shown in Tables S1 and S2. To summarize, agreeableness, realistic, artistic, enterprising, and conventional interests were consistent with scalar invariance across time, as indicated by negligible changes in the fit statistics of the scalar and metric invariance models (i.e.,  $\Delta$  RMSEA  $< .02$ ). Emotional stability, extraversion, openness, conscientiousness, investigative, and social interests were partially consistent with scalar invariance. In each of these trait categories, partial scalar invariance was found by freeing a single parcel at time one. That only one intercept was required to be freely estimated to obtain negligible change in model fit points toward generally acceptable measurement properties. Interestingly, the parcel that was required to be freed for each of the variables was at the first timepoint. Younger participants tend to engage in more acquiescent response sets (Möttus et al., in press; Soto, John, Gosling, & Potter, 2008), which may provide a psychometric explanation for the lack of full scalar invariance concentrated around the first measurement occasion.

Next, we tested for longitudinal measurement invariance across gender using a similar model comparison approach. The fit statistics for each gender invariance model are shown in Tables S3 and S4. Results supported (partial) longitudinal scalar invariance across gender for all personality traits and four of the six interest categories (exceptions: artistic and conventional). Partial scalar invariance across gender was found by freeing two parcels for males at time one for

artistic interests and one parcel for males at time one for conventional interests. We therefore suggest caution in interpreting gender differences in these two interest categories. To reduce model complexity given our relatively modest sample size, we used scale sum scores for all remaining analyses.

### **Rank-Order Stability**

We compared the rank-order stabilities of vocational interests and personality traits across each timepoint (i.e., from age 16-18, 18-22, and 22-24) and over the entire 8-year period (i.e., age 16-24). Table 3 displays the rank-order stability coefficients and 95% confidence intervals for the Big Five traits and RIASEC interests. Figure 3 displays this information graphically. The horizontal dotted lines in Figure 3 represent the average stability coefficients for the Big Five traits and RIASEC interests, respectively, at each timepoint. All rank-order stability coefficients were statistically significant, and there were no gender differences in stability levels. Note that both interests and personality traits became increasingly stable with age, which is consistent with the cumulative continuity principle (Roberts & Mroczek, 2008).

[INSERT TABLE 3 HERE]

Hypothesis 1 predicted that vocational interests would be more stable than the Big Five traits. This hypothesis was not supported. The average stability levels of the Big Five traits and RIASEC interests were very similar from ages 16-18 ( $r = .49$  for personality and interests), 18-22 ( $r = .63$  for personality;  $r = .66$  for interests), 22-24 ( $r = .71$  for personality;  $r = .74$  for interests), and across the entire study ( $r = .41$  for personality;  $r = .38$  for interests). Thus, there were no notable differences in the overall stability levels of interests and personality traits. There were also few differences in the stability levels of specific Big Five traits and interest categories. Most notably, extraversion ( $r = .29$ , 95% CI = [.18, .41]) was the least stable personality trait

from age 16 to 24, while openness was the most stable ( $r = .57$ , 95% CI = [.48, .65]), and these confidence intervals did not overlap. Apart from this distinction, the stability coefficients for each trait category were not statistically different from one another in the vast majority of comparisons. Overall, these results suggest that both interests and personality traits become increasingly stable with age, but neither construct is more stable than the other.

[INSERT FIGURE 3 HERE]

### Mean-level Change

We estimated mean-level changes in interests and personality traits by computing standardized difference scores (i.e.,  $d$ -values) across each time point. Table 4 displays the  $d$ -values for the Big Five traits and RIASEC interests from age 16-18, 18-22, 22-24, and across the entire study from age 16-24. Figure 4 displays this information graphically, with cumulative  $d$ -values representing trajectories of change from age 16 to 24. Hypothesis 2a predicted that personality traits would show evidence of maturation, with increases in mean-levels of emotional stability, conscientiousness, agreeableness, and openness (Roberts et al., 2006). Hypothesis 2b predicted mean-level increases in interest categories that involve people (social, artistic, and enterprising interests), but not things (realistic, investigative, and conventional; Hoff et al., 2018).

[INSERT TABLE 4 HERE]

Results provided moderate support for personality maturation, and no evidence of increasing levels of people-oriented interests. Among the Big Five traits, agreeableness increased the most from age 16 to 24 ( $d = .49$ , 95% CI = [.32, .65]), followed by openness ( $d = .28$ , 95% CI = [.12, .44]) and conscientiousness ( $d = .20$ , 95% CI = [.03, .36]). Emotional stability levels

remained constant ( $d = .02$ , 95% CI = [-.16, .16]), while extraversion levels decreased over the full study ( $d = -.26$ , 95% CI = [-.43, -.10]), despite an increase of  $d = .11$  from age 16 to 18.

Compared to personality traits, mean-level changes in vocational interests were smaller in magnitude and less consistent in direction. The greatest positive changes were found in investigative interests ( $d = .15$ , 95% CI = [-.01, .31]), while artistic interests showed the largest declines ( $d = -.09$ , 95% CI = [-.25, .07]). The other four interest categories showed little cumulative change ( $d$ 's less than or equal to  $|.1|$ ). Together, the mean-level change results suggest that Icelandic youth became more agreeable and open to experience from age 16 to 24, and slightly more conscientious. Yet these increases were not accompanied by consistent changes in vocational interests (apart from a slight increase in investigative interests). In addition, the results suggest a strong trend of decreasing extraversion levels from age 18 to 24.

[INSERT FIGURE 4 HERE]

### **Growth Curve Models**

Next, we formalized the description of personality and interest development using growth curve models. Table 5 reports intercept and slope parameters for each personality trait and interest category. We found statistically significant variance in the intercept and slope for all but one variable. This means that although we estimated relatively little mean-level change for interests, there was still variability in how individuals changed. Some individuals showed greater increases than the dominant trend, while others changed in the opposite direction. The only exception was the slope variance of artistic interests ( $\sigma^2 = 3.99$ ,  $SE = 2.44$ ), which was not statistically different from zero. Nonsignificant slope variance indicates that participants more or less changed in a similar manner in artistic interests. Associations with slopes of artistic interests

are likely estimated imprecisely given the relatively small amount of variance. We now turn to possible correlates of variability in change.

[INSERT TABLE 5 HERE]

**Gender differences in mean-level changes.** Gender differences in mean-level changes were examined using latent growth curve modeling. Generally, the models displayed good fit (RMSEA = .00 – .09; CFI = .92 – 1.00). Table 6 displays the standardized parameter estimates for gender differences in the intercepts and slopes of each Big Five trait and RIASEC category (standardized with respect to the personality and interest scales, but not gender). Gender was dummy-coded in these models such that females were coded as 0 and males were coded as 1. Because of this, positive values indicate that males score higher and negative values indicate that males score lower. For example, in the slope column of Table 6, positive values indicate that men showed a more positive mean-level slope trajectory than women. This would imply that men increased more than women in a given trait (e.g., if the general mean-level trend was positive), or that men decreased less than women (if the general mean-level trend was negative).

[INSERT TABLE 6 HERE]

Results of the gender analyses were mostly consistent with our expectations based on previous research. There were statistically significant gender differences in the intercepts of three Big Five traits and five RIASEC categories. Consistent with our expectations, men scored higher on emotional stability ( $b = .78$ , 95% CI = [.56, 1.00]), and realistic ( $b = 1.10$ , 95% CI = [.90, 1.29]), investigative ( $b = .48$ , 95% CI = [.24, .73]), and conventional interests ( $b = .65$ , 95% CI = [.40, .89]). Women scored higher on extraversion ( $b = -.54$ , 95% CI = [-.83, -.25]), agreeableness ( $b = -.56$ , 95% CI = [-.80, -.33]), and social ( $b = -1.32$ , 95% CI = [-1.55, -1.09]) and artistic interests ( $b = -.52$ , 95% CI = [-.79, -.25]). In addition, there were statistically significant slope

differences in two Big Five traits and one RIASEC category. Women showed a more positive slope trajectory than men in emotional stability ( $b = -.67$ , 95% CI = [-1.10, -.24]) and conscientiousness ( $b = -.36$ , 95% CI = [-.67, -.05]). Men showed a more positive slope trajectory in artistic interests ( $b = .72$ , 95% CI = [.08, 1.36]); however, this association should be interpreted cautiously because we did not find longitudinal scalar invariance across gender for artistic interests. None of the other slope parameters significantly differed across gender. Thus, despite a few exceptions, men and women showed similar patterns of mean-level change in personality and interests from age 16 to 24.

### **Correlated Changes in Interests and Personality Traits**

Our third set of analyses investigated correlated changes among personality traits and vocational interests (i.e., change-change correlations), using the estimate of correlated change among general factors as a comparison point. Although not our primary focus, we also estimated level-level and level-change correlations across domains. Hypothesis 3 predicted strong, positive correlated change in 5 of the 30 pairings of specific Big Five traits and RIASEC interests: extraversion-social, extraversion-enterprising, openness-artistic, openness-investigative, and conscientiousness-conventional. In the other 25 personality-interest pairings, we expected correlated changes to be weaker than, or roughly equal to, the estimate of correlated change among general factors.

Table 7 displays intercorrelations among intercepts (i.e., level-level), among slopes (i.e., change-change), and between intercepts and slopes (i.e., level-change). Figure 5 displays this information graphically. Note that horizontal dotted lines in Figure 5 represent the correlations among general factors of personality and interests. Generally, the models for each specific personality-interest pairing displayed good or acceptable fit (RMSEA = .00 - .07; CFI = .92 –



1.00). Among the change correlations, three of the five hypothesized pairs showed strong, positive relations, supporting hypothesis 3 (extraversion-enterprising,  $r = .60$ , 95% CI = [.24, .95]; openness-artistic,  $r = .88$ , 95% CI = [.41, 1.35]; conscientiousness-conventional,  $r = .35$ , 95% CI = [.20, .65]). However, openness-investigative ( $r = .09$ , 95% CI = [-.40, .58]) and extraversion-social ( $r = .19$ , 95% CI = [-.19, .57]) showed nonsignificant change relations that were weaker than the correlation among general change factors ( $r = .32$ , 95% CI = [.16, .49]). Nonetheless, levels of openness-investigative ( $r = .44$ , 95% CI = [.25, .62]) and extraversion-social ( $r = .47$ , 95% CI = [.23, .71]) were still strongly related, as were levels of the other three hypothesized pairs (level-level correlations ranged from  $r = .33$  for conscientious-conventional to  $r = .82$  for openness-artistic).

[INSERT TABLE 7 HERE]

In the other 25 personality-interest pairings, there were a few notably strong change correlations that exceeded the .32 baseline change correlation among general factors of change. Conscientiousness and enterprising interests showed strong, positive relations in terms of changes ( $r = .53$ , 95% CI = [.30, .77]) and levels ( $r = .42$ , 95% CI = [.24, .60]). Changes in extraversion and conventional interests were strongly correlated ( $r = .63$ , 95% CI = [.23, 1.03]), but their levels were only moderately associated ( $r = .28$ , 95% CI = [.01, .54]). Two other personality-interest pairings were notable because they showed moderately strong negative change-change correlations. Openness-realistic ( $r = -.37$ , 95% CI = [-.83, .10]) and openness-conventional ( $r = -.31$ , 95% CI = [-.73, .11]) both diverged from the general trend of positively correlated slopes, although their confidence intervals included zero.

[INSERT FIGURE 5 HERE]

Level-change correlations are also reported in Table 7. These correlations reflect the extent to which personality levels are related to interest changes, and vice versa for interest levels and personality changes. In both sets of analyses, the vast majority of level-change correlations were negative. This implies that in general, individuals with higher personality trait levels at time one experienced less growth in their interest scores over time (with the same effect for interest levels and personality trait changes). These cross-domain ceiling effects were most notable for conscientiousness and extraversion compared to the other Big Five traits. Higher levels of extraversion ( $r = -.36$ , 95% CI = [-.57, -.15]) and conscientiousness ( $r = -.25$ , 95% CI = [-.41, -.09]) were associated with more negative changes in the general interest factor. There was also a negative correlation between general personality levels and general changes in interests ( $r = -.30$ , 95% CI = [-.45, -.14]).

### Discussion

The current study investigated the longitudinal development of personality and interests over four waves of measurement from late adolescence to young adulthood (ages 16-24) with a sample of Icelandic youth. We focused on three types of continuity and change: rank-order stability, mean-level change, and cross-domain correlated change. Personality traits and interests both became increasingly stable across the four time points, consistent with the cumulative continuity principle (Roberts & Caspi, 2003). This finding is noteworthy because the retest interval between times 2-3 was twice as long as between times 1-2 and 3-4. Although rank-order stability typically decreases over longer periods of time (Fraley & Roberts, 2005), increasing age appeared to outweigh these effects. In addition, there were essentially no differences in the average stability levels of personality and interests. Unlike meta-analytic comparisons of different samples (Low et al, 2005; Roberts & Delvecchio, 2000), our results suggest that

vocational interests and personality traits are equally stable when measured within the same sample.

Our second set of analyses focused on mean-level change while considering the potential for gender differences. We hypothesized mean-level increases among personality traits associated with social maturity (Roberts et al., 2006), and among interests that involve people (Hoff et al., 2018). Results revealed evidence of increasing personality maturity, as mean-level increases were found in agreeableness, openness, and conscientiousness from age 16 to 24. Emotional stability levels remained constant, while extraversion levels decreased. In general, the greatest mean-level changes in personality occurred from age 18-22 (times 2-3), which could be expected because this retest interval was twice as long as the others. Longer retest intervals are typically associated with greater mean-level change (Fraley & Roberts, 2005). For the interest categories, there was very little cumulative change in mean-levels. This finding differs somewhat from the meta-analysis of U.S. samples (Hoff et al., 2018). In addition, gender differences were found in changes in emotional stability and conscientiousness, indicating that women increased more than men in both of these traits. This means that the gender gap in emotional stability decreased over time (women started lower), while the gender gap in conscientiousness increased (there were no differences in starting levels). The only significant gender difference in interest changes occurred in artistic interests, indicating that men increased slightly more than women in this category.

Our third set of analyses examined correlated change between the Big Five traits and RIASEC interests. We hypothesized strong, positive correlated change in five specific personality-interest pairings based on previous cross-sectional research and the shared situations embedded in these trait categories (Mount et al., 2005; Wrzus & Roberts, 2016). We also

estimated correlated change among general factors of personality and interests ( $r = .32$ ), which was used as a comparison point for interpreting the magnitude of correlations among specific traits. Three of the five hypothesized pairings of Big Five traits and RIASEC interests showed strong correlated change exceeding the estimate among general factors (extraversion-enterprising, openness-artistic, and conscientiousness-conventional). The other two hypothesized pairings (extraversion-social and openness-investigative) were not strongly related in terms of changes, but their levels were strongly related. This suggests that the developmental mechanisms that cause positive relations in these two pairings likely occur prior to age 16. In other words, extraversion-social and openness-investigative do not appear to change together during young adulthood, even though people who are more extraverted and open tend to have stronger social and investigative interests, respectively.

Evidence of strong, positive correlated change was also found in two of the other 25 personality-interest pairings not included in our hypotheses. Changes in conscientiousness and enterprising interests were strongly related, as were changes in extraversion and conventional interests. Although these findings were unexpected, they indicate potentially meaningful developmental relations between changes in business-oriented interests and extraversion and conscientiousness. Changes in extraversion and conscientiousness were both strongly related to changes in enterprising and conventional interests, indicating that people who become more extraverted and conscientious during young adulthood also become more interested in business-oriented activities. It is also worth noting that changes in openness showed moderately strong negative correlations with changes in realistic and conventional interests. This suggests that people who become more open during young adulthood generally become less interested in systematic work activities that involve working with computers, tools, or machines. The

remaining 21 personality-interest pairings showed relatively weak correlated change (with  $r$ 's equal to, or less than, the estimate of correlated change among general factors).

### **Understanding the Developmental Relations between Interests and Personality**

One of the primary conclusions of the current study is that interests and personality show distinct developmental relations across different types of continuity and change. Most notably, there was little correspondence between group-level (mean) changes, but strong correspondence between individual-level changes in certain personality-interest pairings (i.e., correlated change). In other words, the specific pairings of Big Five traits and RIASEC interests that changed together at the individual-level did not show the same patterns of mean-level change. This highlights the importance of examining development from multiple perspectives (e.g., Anusic & Schimmack, 2016; De Fruyt et al., 2006). Interests and personality traits change together in meaningful ways, but these relations may not be observable when comparing group means in a single study. Consistent with our findings, meta-analyses have shown that mean-level changes in interests are smaller in magnitude and occur more gradually than personality (Hoff et al., 2018; Roberts et al., 2006).

A critical question raised by the current study is *why* correlated changes occur between certain personality traits and interests. Wrzus and Roberts' (2016) TESSERA model of developmental processes provides a framework for addressing this question. Their model emphasizes the shared situational content across personality traits and other individual differences. According to their model, situations that repeatedly trigger short-term changes in states lead to long-term changes in traits through self-reflection and association. For example, a student who repeatedly experiences success/enjoyment in art or design courses will eventually learn to associate these situations with positive emotions. Over time, reflective and associative

processes will gradually lead to increases in openness to experience and corresponding artistic interests. Importantly, this basic framework—emphasizing situational similarity—can be applied to a variety of causal mechanisms that may influence personality, interests, or other relevant individual differences (e.g., biology or life experiences, Bleidorn et al., 2018; DeYoung & Gray, 2009; Specht et al., 2014; Tucker-Drob & Briley, 2017).

An alternative but not mutually exclusive perspective is that correlated change results from directional influences from personality to interests, or vice versa. McCrae & Costa's (1999, 2008) five-factor theory is an example of this perspective because it argues that personality traits (which are closely linked to biology in their model) cause the development of interests and other contextualized variables (i.e., characteristic adaptations). For example, a person who increases in openness may develop stronger artistic interests as a way to express their openness levels. However, the reverse causality may also be true: becoming interested in artistic pursuits may lead to higher levels of openness. A reasonable deduction is that interests and personality are reciprocally influential across development. Causal processes that lead to changes in one domain also likely affect the other domain, but only when trait categories are similar in some way. Abilities that share common situations with interests and personality are also important to consider (Ackerman, 1996; Ackerman & Heggstad, 1997; Pässler, Beinicke, & Hell, 2015; Su, Stoll, & Rounds, in press; Ziegler, Schroeter, Lüdtke, & Roemer, 2018).

Most pairs of interests and personality traits that changed together share some degree of situational content, even those not included in our five hypothesized pairs. For example, conscientiousness and enterprising interests share a common focus on getting ahead in work and business contexts. Strong correlated change may have occurred in these two dimensions because conscientious behaviors, particularly those related to achievement striving, are often rewarded in

work settings and can help individuals achieve positions of influence (Nye & Roberts, 2013). In a less direct manner, conventional interests and extraversion are also related through business contexts, where higher levels of extraversion can be advantageous. Openness, realistic, and conventional interests are divergently related in that many activities that comprise realistic and conventional interests involve systematic work routines in structured environments (e.g., filing paperwork, organizing goods, using industrial equipment). These types of activities oppose the situations embedded in openness (see also Hogan, 1983).

The general factor correlations also indicate some degree of situational commonality shared by all personality traits and interest categories. Broad developmental mechanisms may lead to general changes in interest and personality because certain situations are relevant across trait categories. For example, social skills are valued in almost all interpersonal and work settings. Students interested in pursuing a field of study or occupation, regardless of its content, will typically benefit by learning how to effectively manage their time and get along with peers, coworkers, or supervisors. This broad incentive structure helps explain why mean-levels of most personality traits and interest categories increase during late adolescence and young adulthood (Hoff et al., 2018; Roberts et al., 2006). In general, individuals who become more socially mature in their personality will have more opportunities to express and build upon their interests (Hogan & Blake, 1999).

### **Limitations and Future Directions**

Our study's joint focus on the developmental structure of interests and personality helps integrate research from two areas of study with different traditions. Integration has become an increasingly important issue in personality psychology and in the broader study of individual differences (e.g., Baumert et al., 2017; Denissen, Van Aken, Penke, & Wood, 2013; Wrzus &

Roberts, 2016). Our results show that interests and personality traits change together in meaningful ways during young adulthood, but there are likely different patterns of correlated change at other periods of the lifespan (e.g., Kandler, Kornadt, Hagemeyer, & Neyer, 2015; Wrzus, Wagner, & Riediger, 2016). In addition, interests and personality traits showed different patterns of relations across the three types of continuity and change, highlighting the importance of assessing development in multiple ways.

Our sample is unique in that there has yet to be a long-term longitudinal study on personality or interests with an Icelandic population. This provides a way of examining the generalizability of findings from developmental studies in other countries. There were also several limitations. In Iceland, education is compulsory from ages 6-16 (grades 1-10) and students came from 21 total schools at time one. This resulted in a multilevel structure of the dataset. We were unable to apply cluster-robust standard errors in the analyses because of the relatively small number of clusters (i.e., schools) and unbalanced numbers of participants in each cluster (McNeish, Stapleton, & Silverman, 2017). However, the participants pursued a variety of different educational and career pathways at times two, three, and four, which is common among Icelandic young adults (Statistics Iceland, 2012). The divergent educational and career pathways of Icelandic youth may also help explain why there was not a clear pattern of mean-level changes in interest levels.

Certain findings from our study should be viewed in context. In particular, the magnitude of correlated change coefficients between interest and personality dimensions should be viewed as tentative estimates, given that they emerged from a single sample. Methodological issues could also be at play. Strong estimates of correlated change can be obtained when there is relatively little variance in change. This helps explain the notably strong correlated change



estimate between artistic interests and openness ( $r = .88$ ). The general factor model results should also be interpreted with some caution due to the high level of collinearity between intercept and slope factors among RIASEC dimensions. We tested alternative models to ensure the robustness of the general interest factor model, but future work could further investigate differing approaches to modeling the general interest factor (e.g., Shermer & Goffin, 2018; Tracey, 2012). We also did not find scalar measurement invariance for all variables. However, deviations from scalar invariance were minor and tended to be concentrated at the youngest wave, raising the possibility that age-related response sets might play an outsized role at the initial time point. In addition, all data was self-reported at each wave. Our findings therefore represent personality and interest development from the actor's perspective, not from an observer's point of view (Branje, Van Lieshout, & Gerris, 2007; Hogan & Blake, 1999).

Future research is needed that replicates our results in different countries, contexts, and age periods. Future longitudinal studies could also benefit by including more frequent retest intervals. Examining change more precisely across life transitions may reveal more about the events in-between assessments that affect development (e.g., Denissen, Luhmann, Chung, & Bleidorn, 2018). It is also important for future studies to examine correlated change with other constructs. Studying correlated change with abilities can help test some of the causal mechanisms proposed by developmental theories that integrate personality, interests, and abilities (e.g., Ackerman, 1996; Gottfredson, 1981, 2005; Roberts & Wood, 2006; Schmidt, 2014; Wrzus & Roberts, 2016). Work attitudes, such as job satisfaction and organizational commitment, are also important to consider as they may play a role in personality maturation (Hudson et al., 2012; Wille et al., 2014). More broadly, future studies can benefit by viewing interests and personality as interrelated developmental constructs.

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## TABLES

Table 1. *Overview of RIASEC Interests and Cross-Sectional Relations with Personality Traits*

Interest category	Brief description (example occupations)	Big Five cross-sectional correlate ( $r$ )	Shared situational content and activities/characteristics
Realistic	Working with hands, tools, and materials (farmworker, civil engineer, carpenter)	--	--
Investigative	Scientific and research pursuits (biologist, veterinarian, chemist)	Openness (.25)	Appreciation for science, intellectual curiosity
Artistic	Self-expression and creativity typically associated with the performing, written, & visual arts (actor, writer)	Openness (.41)	Appreciation for arts, openness to new ideas and lifestyles
Social	Helping, nurturing, and mentoring (counselor, teacher, child and family social worker)	Extraversion (.29)	Helping others in socially-oriented environments
Enterprising	Selling, managing, and social influence typically in a business context (managers, salespersons)	Extraversion (.40)	Influencing or leading others in socially-oriented environments
Conventional	Ordered and systematic manipulation of data with clear standards (accountant, bank teller, inspectors)	Conscientiousness (.19)	Organized and structured tasks, goals, and environments

*Note.* Interest categories are based on Holland's (1959, 1997) RIASEC Model. Cross-sectional correlations are based on meta-analytic estimates from Mount, Barrick, Scullen, & Rounds (2005; Table 3, p. 463).

Table 2. Means, Standard Deviations, and Internal Consistency of Personality Traits and Interests at Each Time Point

	<u>Time 1 (age 16)</u>				<u>Time 2 (age 18)</u>				<u>Time 3 (age 22)</u>				<u>Time 4 (age 24)</u>			
	M	SD	$\alpha$	$\omega$	M	SD	$\alpha$	$\omega$	M	SD	$\alpha$	$\omega$	M	SD	$\alpha$	$\omega$
Personality traits																
Emotional Stability	27.55	8.41	.73	.87	27.23	9.18	.88	.90	28.00	8.79	.87	.89	27.53	8.46	.85	.88
Extraversion	43.75	6.09	.74	.81	44.43	5.67	.75	.81	42.97	6.18	.79	.85	42.14	6.16	.80	.85
Openness	37.13	6.09	.65	.70	37.02	6.52	.71	.76	38.64	6.92	.76	.80	38.89	6.75	.76	.79
Agreeableness	41.34	5.81	.68	.75	42.45	5.92	.74	.79	43.13	6.24	.78	.82	44.13	5.48	.72	.79
Conscientiousness	41.62	7.54	.85	.88	41.71	8.14	.88	.91	42.53	8.08	.88	.91	43.10	7.62	.86	.90
Interests																
Realistic	39.12	13.55	.93	.95	39.37	14.08	.94	.95	38.17	15.18	.95	.96	38.60	14.02	.94	.96
Investigative	50.54	15.31	.91	.93	50.67	15.21	.90	.93	52.05	15.17	.91	.93	52.80	14.83	.91	.93
Artistic	66.26	17.04	.92	.93	69.77	16.06	.91	.93	66.04	17.94	.93	.94	64.65	18.51	.94	.95
Social	53.08	14.36	.92	.94	55.42	14.19	.92	.94	55.43	14.87	.93	.94	53.61	15.20	.93	.94
Enterprising	47.25	13.55	.92	.94	48.42	13.71	.90	.93	46.82	14.30	.93	.94	48.55	13.53	.92	.94
Conventional	51.38	14.52	.92	.94	52.37	15.48	.91	.94	50.40	15.50	.92	.94	52.36	14.71	.91	.94

*Note.* There were 12 items for each Big Five scale. The number of items per RIASEC scale ranged from 17 to 22 (17 items for Realistic, 19 for Investigative, 22 for Artistic, 18 for Social, 17 for Enterprising, and 21 for Conventional).  $\alpha$  = Cronbach's alpha.  $\omega$  = Revelle's omega total coefficient.

Table 3. Rank-order Stabilities of Personality Traits and Vocational Interests

	<u>Age 16-18 (T1-T2)</u>		<u>Age 18-22 (T2-T3)</u>		<u>Age 22-24 (T3-T4)</u>		<u>Age 16-24 (T1-T4)</u>	
	<i>r</i>	95% CI	<i>r</i>	95% CI	<i>r</i>	95% CI	<i>r</i>	95% CI
Personality Traits								
Emotional Stability	.53	[.44, .62]	.70	[.62, .78]	.71	[.64, .78]	.45	[.35, .54]
Extraversion	.34	[.22, .45]	.54	[.41, .67]	.67	[.59, .75]	.29	[.18, .41]
Openness	.53	[.44, .62]	.79	[.73, .85]	.81	[.75, .86]	.57	[.48, .65]
Agreeableness	.48	[.38, .58]	.55	[.44, .66]	.64	[.55, .72]	.36	[.25, .47]
Conscientiousness	.57	[.48, .66]	.55	[.45, .66]	.74	[.67, .81]	.38	[.28, .48]
<i>Big Five Average</i>	.49		.63		.71		.41	
Vocational Interests								
Realistic	.57	[.49, .66]	.78	[.71, .84]	.78	[.72, .84]	.39	[.29, .50]
Investigative	.50	[.40, .60]	.67	[.58, .75]	.75	[.69, .81]	.44	[.34, .54]
Artistic	.44	[.33, .54]	.73	[.65, .80]	.72	[.64, .79]	.45	[.35, .55]
Social	.53	[.43, .63]	.58	[.47, .69]	.77	[.71, .83]	.41	[.31, .52]
Enterprising	.49	[.39, .59]	.64	[.56, .73]	.73	[.66, .80]	.31	[.19, .43]
Conventional	.41	[.30, .51]	.59	[.49, .69]	.67	[.59, .76]	.26	[.14, .38]
<i>RIASEC Average</i>	.49		.66		.74		.38	

Note. *r* = rank-order stability (correlation coefficient); 95% CI = 95% confidence interval. *Big Five Average* and *RIASEC Average* represent the mean stability coefficient for all personality and interest categories, respectively, across each measurement wave. Gender and home location were included as auxiliary variables in these models.

Table 4. Mean-Level Changes in Personality Traits and Vocational Interests

	<u>Age 16-18 (T1-T2)</u>		<u>Age 18-22 (T2-T3)</u>		<u>Age 22-24 (T3-T4)</u>		<u>Age 16-24 (T1-T4)</u>	
	<i>d</i>	95% CI	<i>d</i>	95% CI	<i>d</i>	95% CI	<i>d</i>	95% CI
Personality Traits								
Emotional Stability	-.04	[-.21, .13]	.09	[-.11, .28]	-.05	[-.24, .13]	.00	[-.16, .16]
Extraversion	.11	[-.05, .28]	-.24	[-.44, -.05]	-.13	[-.32, .05]	-.26	[-.43, -.10]
Openness	-.02	[-.19, .15]	.24	[.05, .43]	.04	[-.15, .22]	.28	[.12, .44]
Agreeableness	.19	[.02, .36]	.11	[-.08, .30]	.17	[-.02, .35]	.49	[.32, .65]
Conscientiousness	.01	[-.16, .18]	.10	[-.09, .29]	.07	[-.11, .26]	.20	[.03, .36]
Vocational Interests								
Realistic	.02	[-.15, .19]	-.08	[-.27, .11]	.03	[-.16, .22]	-.04	[-.20, .12]
Investigative	.01	[-.16, .18]	.09	[-.10, .28]	.05	[-.14, .24]	.15	[-.01, .31]
Artistic	.21	[.04, .38]	-.22	[-.41, -.02]	-.08	[-.26, .11]	-.09	[-.25, .07]
Social	.16	[-.01, .33]	.00	[-.19, .19]	-.12	[-.26, .07]	.04	[-.13, .20]
Enterprising	.09	[-.08, .25]	-.11	[-.31, .08]	.12	[-.06, .31]	.10	[-.07, .26]
Conventional	.07	[-.10, .24]	-.13	[-.32, .07]	.13	[-.06, .32]	.07	[-.09, .23]

Note. *d* = standardized mean difference, negative values indicate decreases over time; 95% CI = 95% confidence interval. Gender and home location were included as auxiliary variables in these models.

Table 5. *Latent Growth Curve Results Modeling Levels and Changes of Personality Traits and Vocational Interests*

	<u>Intercepts</u>				<u>Slopes</u>				RMSEA	<u>Fit Indices</u>			
	<i>Mean</i>	<i>SE (M)</i>	$\sigma^2$	<i>SE(<math>\sigma^2</math>)</i>	<i>Mean</i>	<i>SE (M)</i>	$\sigma^2$	<i>SE(<math>\sigma^2</math>)</i>		$\chi^2$	CFI	TLI	SRMR
Personality Traits													
Emotional Stability	27.63	0.38	<b>40.89</b>	5.48	-0.03	0.13	<b>1.66</b>	0.57	0.07	16.33	0.97	0.96	0.05
Extraversion	44.11	0.26	<b>12.32</b>	2.79	-0.43	0.10	<b>0.87</b>	0.35	0.07	16.98	0.94	0.92	0.05
Openness	37.00	0.27	<b>18.22</b>	2.67	0.52	0.09	<b>0.67</b>	0.28	0.08	20.70	0.96	0.96	0.05
Agreeableness	41.49	0.26	<b>16.21</b>	2.59	0.68	0.09	<b>0.95</b>	0.28	0.05	10.47	0.98	0.97	0.04
Conscientiousness	41.61	0.34	<b>33.18</b>	4.58	0.27	0.12	<b>2.45</b>	0.50	0.00	2.55	1.00	1.01	0.03
Vocational Interests													
Realistic	39.03	0.60	<b>100.51</b>	13.17	-0.17	0.21	<b>6.79</b>	1.60	0.10	30.25	0.93	0.91	0.07
Investigative	50.57	0.66	<b>105.81</b>	17.35	0.56	0.23	<b>5.26</b>	1.78	0.03	7.01	0.99	0.99	0.03
Artistic	67.40	0.74	<b>108.37</b>	20.44	-0.62	0.27	3.99	2.44	0.08	21.78	0.94	0.93	0.05
Social	53.65	0.63	<b>106.13</b>	16.68	0.28	0.25	<b>9.72</b>	1.96	0.08	19.49	0.94	0.93	0.04
Enterprising	47.29	0.59	<b>93.55</b>	14.72	0.17	0.23	<b>9.09</b>	1.80	0.09	23.32	0.92	0.90	0.04
Conventional	51.36	0.64	<b>98.14</b>	17.34	0.09	0.26	<b>9.61</b>	2.25	0.05	10.21	0.97	0.96	0.03

*Note.* Bolded values indicate statistically significant variance ( $p < .05$ ).  $df = 5$  for all models presented in the table. Gender and home location were included as auxiliary variables in these models.

Table 6. *Gender Differences in Levels and Changes of Personality Traits and Vocational Interests*

	<u>Intercepts</u>		<u>Slopes</u>		RMSEA	<u>Fit Indices</u>			
	<i>b</i>	95% CI	<i>b</i>	95% CI		$\chi^2$	CFI	TLI	SRMR
Personality Traits									
Emotional Stability	0.78	[.56, 1.00]	-0.67	[-1.10, -.24]	.06	18.55	0.97	0.96	.09
Extraversion	-0.54	[-.83, -.25]	0.21	[-.22, .63]	.05	16.94	0.95	0.93	.06
Openness	-0.01	[-.25, .24]	0.41	[-.02, .83]	.07	21.31	0.97	0.95	.13
Agreeableness	-0.56	[-.80, -.33]	0.08	[-.27, .43]	.04	11.08	0.98	0.98	.07
Conscientiousness	-0.16	[-.39, .07]	-0.36	[-.67, -.05]	.00	6.87	1.00	1.00	.06
Vocational Interests									
Realistic	1.10	[.90, 1.29]	-0.11	[-.43, .20]	.09	35.93	0.93	0.91	.08
Investigative	0.48	[.24, .73]	-0.05	[-.44, .33]	.01	7.48	1.00	1.00	.04
Artistic	-0.52	[-.79, -.25]	0.72	[.08, 1.36]	.07	25.04	0.94	0.92	.04
Social	-1.32	[-1.55, -1.09]	0.28	[-.04, .59]	.08	26.35	0.95	0.93	.05
Enterprising	0.15	[-.09, .39]	-0.07	[-.37, .24]	.07	24.52	0.92	0.88	.07
Conventional	0.65	[.40, .89]	-0.20	[-.52, .13]	.04	11.48	0.98	0.97	.05

*Note.* *b* illustrates the magnitude and direction of gender differences in the intercepts and slopes of each trait category, standardized with respect to the interest or personality scale; positive *b* coefficients indicate higher intercepts or more positive slopes among men compared to women (and vice versa for negative *b* coefficients).  $df = 7$  for all models presented in this table. Home location was included as an auxiliary variable in these models.

Table 7. *Correlations among Levels and Changes in Personality Traits and Vocational Interests*

Parameter estimates and SEs from full level and change correlation matrix												
	<u>Emotional Stab.</u>		<u>Extraversion</u>		<u>Openness</u>		<u>Agreeableness</u>		<u>Conscientiousness</u>		<u>General P. Factor</u>	
Level-Level												
Realistic	.18	(.09)	-.20	(.12)	-.04	(.10)	-.18	(.10)	.01	(.09)	-.02	(.09)
Investigative	<b>.25</b>	(.10)	-.05	(.14)	<b>.44</b>	(.09)	.07	(.11)	<b>.29</b>	<b>(.10)</b>	<b>.32</b>	(.10)
Artistic	.03	(.11)	-.03	(.15)	<b>.82</b>	(.08)	.05	(.12)	-.04	(.11)	-.06	(.15)
Social	<b>-.24</b>	(.10)	<b>.47</b>	(.12)	.19	(.10)	.08	(.11)	.10	(.10)	.16	(.11)
Enterprising	<b>.29</b>	(.10)	<b>.51</b>	(.12)	-.10	(.11)	-.22	(.11)	<b>.42</b>	<b>(.09)</b>	<b>.52</b>	(.09)
Conventional	<b>.33</b>	(.11)	<b>.28</b>	(.13)	-.18	(.12)	-.18	(.12)	<b>.33</b>	<b>(.10)</b>	<b>.39</b>	(.10)
General I. Factor	<b>.25</b>	(.07)	<b>.38</b>	(.10)	.17	(.09)	-.12	(.08)	<b>.37</b>	(.07)	<b>.38</b>	(.06)
	<u>Δ Emotional Stab.</u>	<u>Δ Extraversion</u>	<u>Δ Openness</u>	<u>Δ Agreeableness</u>	<u>Δ Conscientiousness</u>	<u>Δ General P. Factor</u>						
Change-Change												
Δ Realistic	.01	(.20)	.28	(.20)	-.37	(.24)	-.22	(.18)	.17	(.15)	.11	(.12)
Δ Investigative	-.16	(.25)	-.02	(.27)	.09	(.25)	-.16	(.22)	.01	(.18)	-.02	(.15)
Δ Artistic	-.04	(.31)	-.12	(.35)	<b>.88</b>	(.24)	.26	(.29)	-.10	(.24)	-.33	(.38)
Δ Social	-.03	(.19)	.19	(.19)	.09	(.21)	.10	(.18)	-.03	(.15)	.02	(.12)
Δ Enterprising	.27	(.18)	<b>.60</b>	(.18)	-.06	(.20)	-.15	(.17)	<b>.53</b>	(.12)	<b>.48</b>	(.12)
Δ Conventional	.16	(.20)	<b>.63</b>	(.20)	-.31	(.22)	-.23	(.19)	<b>.35</b>	(.14)	<b>.37</b>	(.12)
Δ General I. Factor	.09	(.12)	<b>.50</b>	(.13)	.24	(.17)	-.10	(.12)	<b>.36</b>	(.10)	<b>.32</b>	(.09)
	<u>Emotional Stab.</u>	<u>Extraversion</u>	<u>Openness</u>	<u>Agreeableness</u>	<u>Conscientiousness</u>	<u>General P. Factor</u>						
Level-Change												
Δ Realistic	.03	(.12)	-.16	(.16)	<b>.33</b>	(.13)	.02	(.13)	-.16	(.12)	-.09	(.11)
Δ Investigative	.04	(.15)	-.29	(.19)	.07	(.16)	-.12	(.17)	-.22	(.14)	-.25	(.14)
Δ Artistic	-.21	(.20)	.06	(.27)	.12	(.21)	-.10	(.20)	-.07	(.19)	.08	(.29)
Δ Social	-.03	(.11)	-.23	(.15)	-.04	(.12)	.09	(.12)	-.07	(.12)	-.07	(.11)
Δ Enterprising	-.19	(.11)	-.23	(.14)	.04	(.12)	-.03	(.12)	<b>-.28</b>	(.11)	<b>-.30</b>	(.11)
Δ Conventional	-.15	(.12)	<b>-.36</b>	(.15)	.13	(.13)	-.10	(.14)	-.21	(.12)	<b>-.31</b>	(.12)
Δ General I. Factor	-.13	(.08)	<b>-.36</b>	(.11)	-.08	(.10)	-.05	(.09)	<b>-.25</b>	(.08)	<b>-.30</b>	(.08)
	<u>Δ Emotional Stab.</u>	<u>Δ Extraversion</u>	<u>Δ Openness</u>	<u>Δ Agreeableness</u>	<u>Δ Conscientiousness</u>	<u>Δ General P. Factor</u>						
Level-Change												
Realistic	-.28	(.15)	-.18	(.16)	.12	(.17)	-.09	(.14)	<b>-.26</b>	(.12)	<b>-.25</b>	(.10)
Investigative	-.10	(.17)	.05	(.19)	.12	(.19)	-.08	(.15)	<b>-.29</b>	(.12)	<b>-.23</b>	(.11)
Artistic	-.05	(.18)	-.12	(.19)	.08	(.21)	-.14	(.16)	-.23	(.13)	-.16	(.15)
Social	.30	(.17)	-.15	(.18)	-.01	(.19)	.10	(.16)	.05	(.14)	.04	(.13)
Enterprising	-.16	(.17)	-.26	(.17)	.05	(.19)	.15	(.16)	<b>-.29</b>	(.12)	<b>-.26</b>	(.12)
Conventional	-.26	(.17)	-.29	(.17)	.21	(.19)	.17	(.16)	<b>-.29</b>	(.12)	<b>-.32</b>	(.11)
General I. Factor	-.17	(.11)	<b>-.29</b>	(.11)	-.18	(.15)	.05	(.11)	<b>-.33</b>	(.09)	<b>-.29</b>	(.08)

*Note.* Standard errors are shown in parentheses. Bolded coefficients have confidence intervals that do not include zero. General P. Factor = General Personality Factor; General I. Factor = General Interests Factor. Gender and home location were included as auxiliary variables in these models.

FIGURES

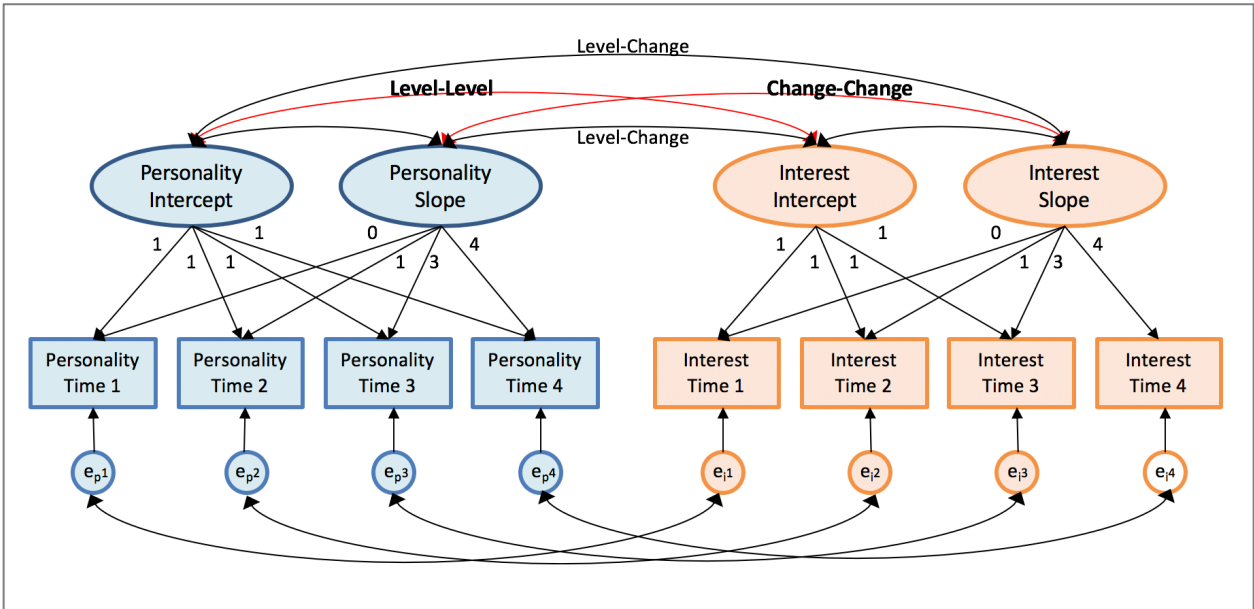


Figure 1. Path diagram of growth curve model examining intercorrelations among levels and changes of personality and interests. The model illustrated in the figure was estimated in 30 separate models for all pairings of Big Five traits and RIASEC interests, and corresponds to the results in Table 7.



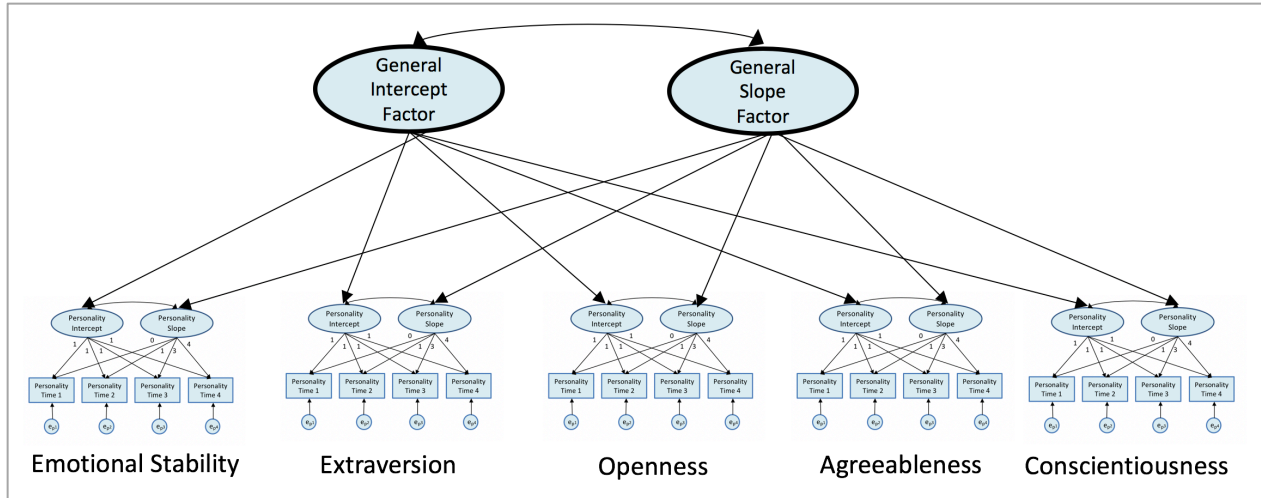


Figure 2. Path diagram of growth curve model for general factor of personality. Note that the general factor of interest was estimated using the same structure.

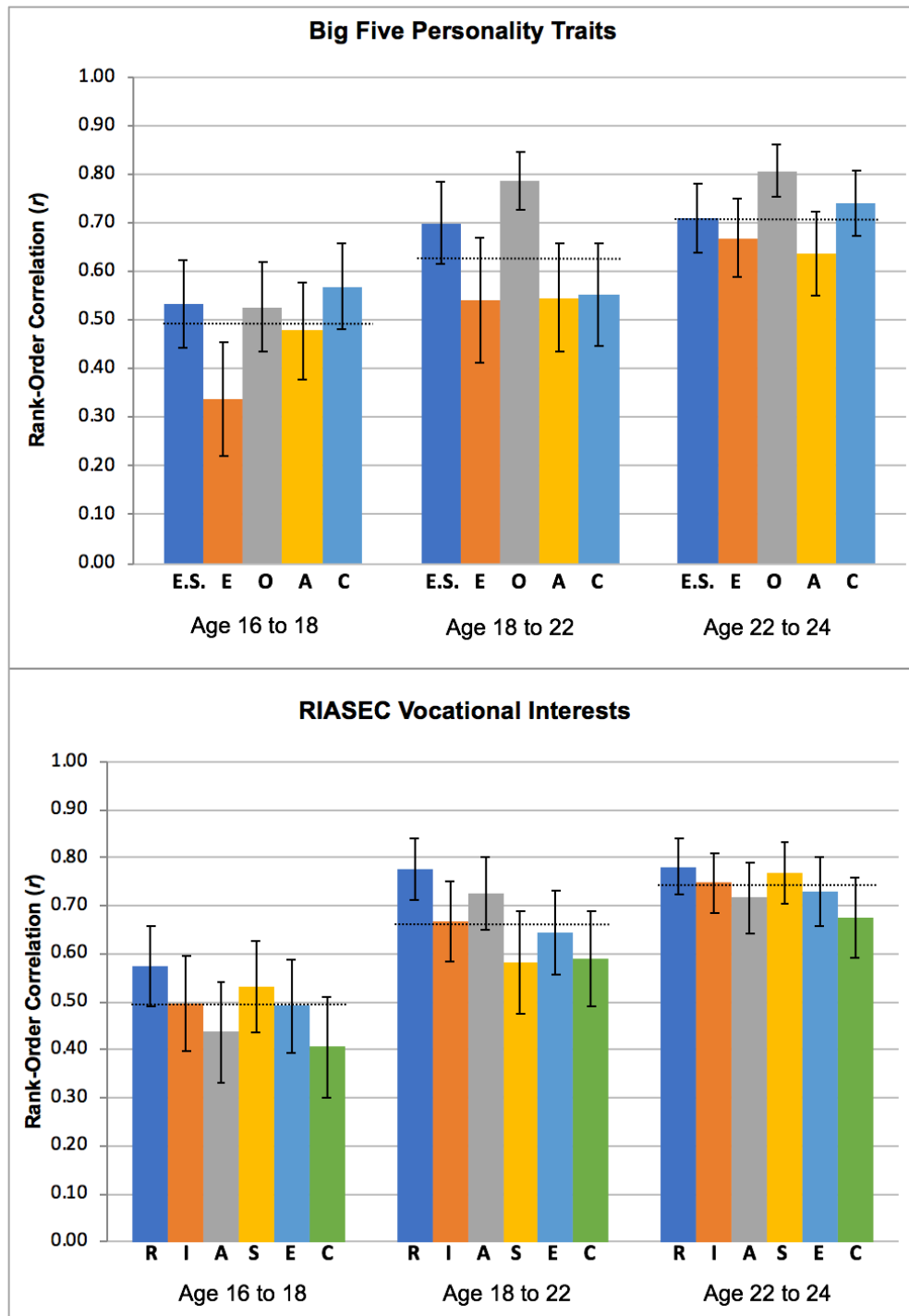


Figure 3. Rank-order stabilities of personality and interests. Dotted lines represent the average stability coefficients for Big Five traits and RIASEC interests, respectively. Error bars denote 95% confidence intervals. For Big Five Personality Traits (top), E.S. = Emotional Stability; E = Extraversion; O = Openness to Experience; A = Agreeableness; C = Conscientiousness. For RIASEC Vocational Interests (bottom), R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional.

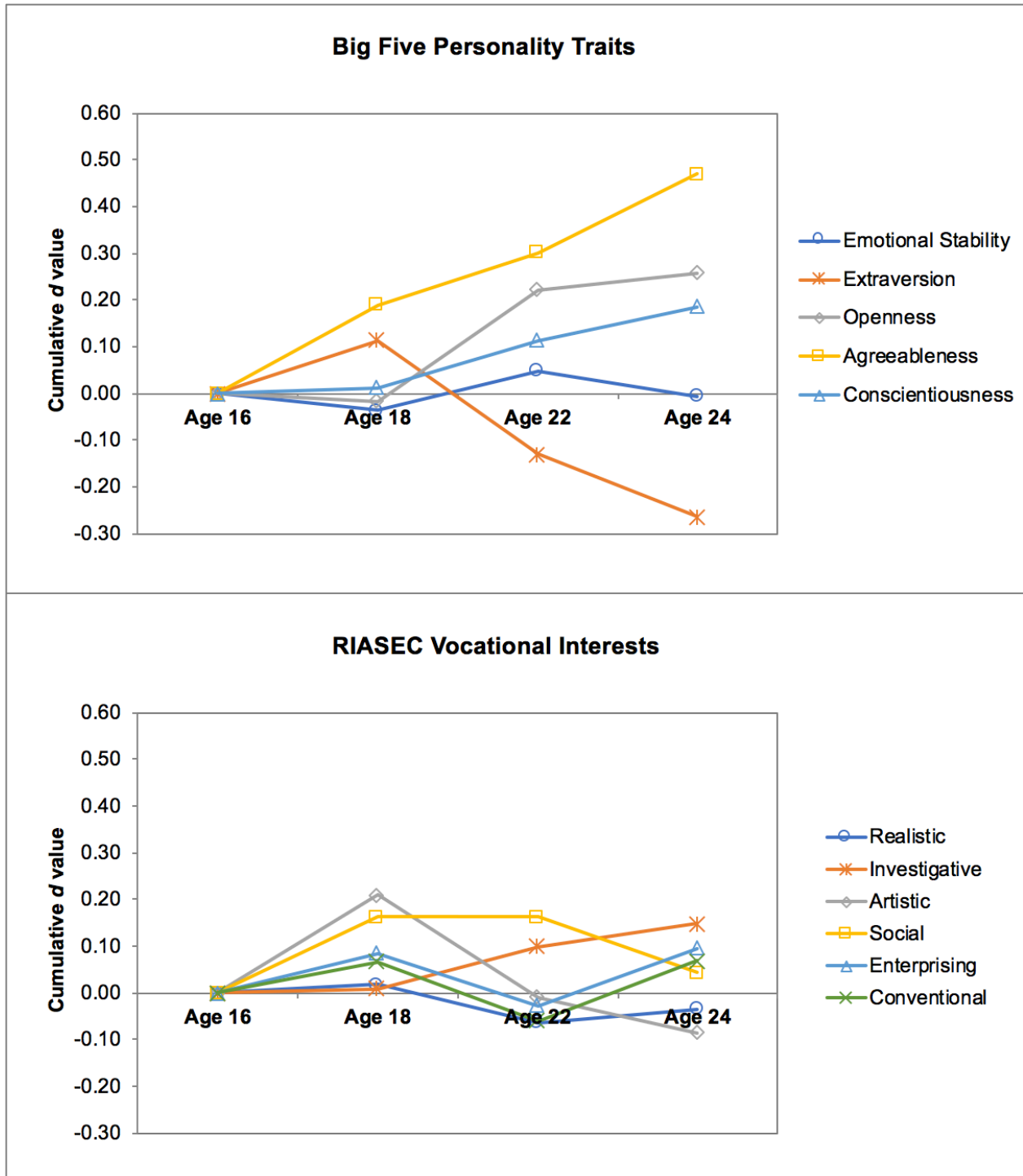


Figure 4. Mean-level changes in personality and interests. Cumulative *d*-values represent standardized difference scores between mean-levels at each subsequent time point.

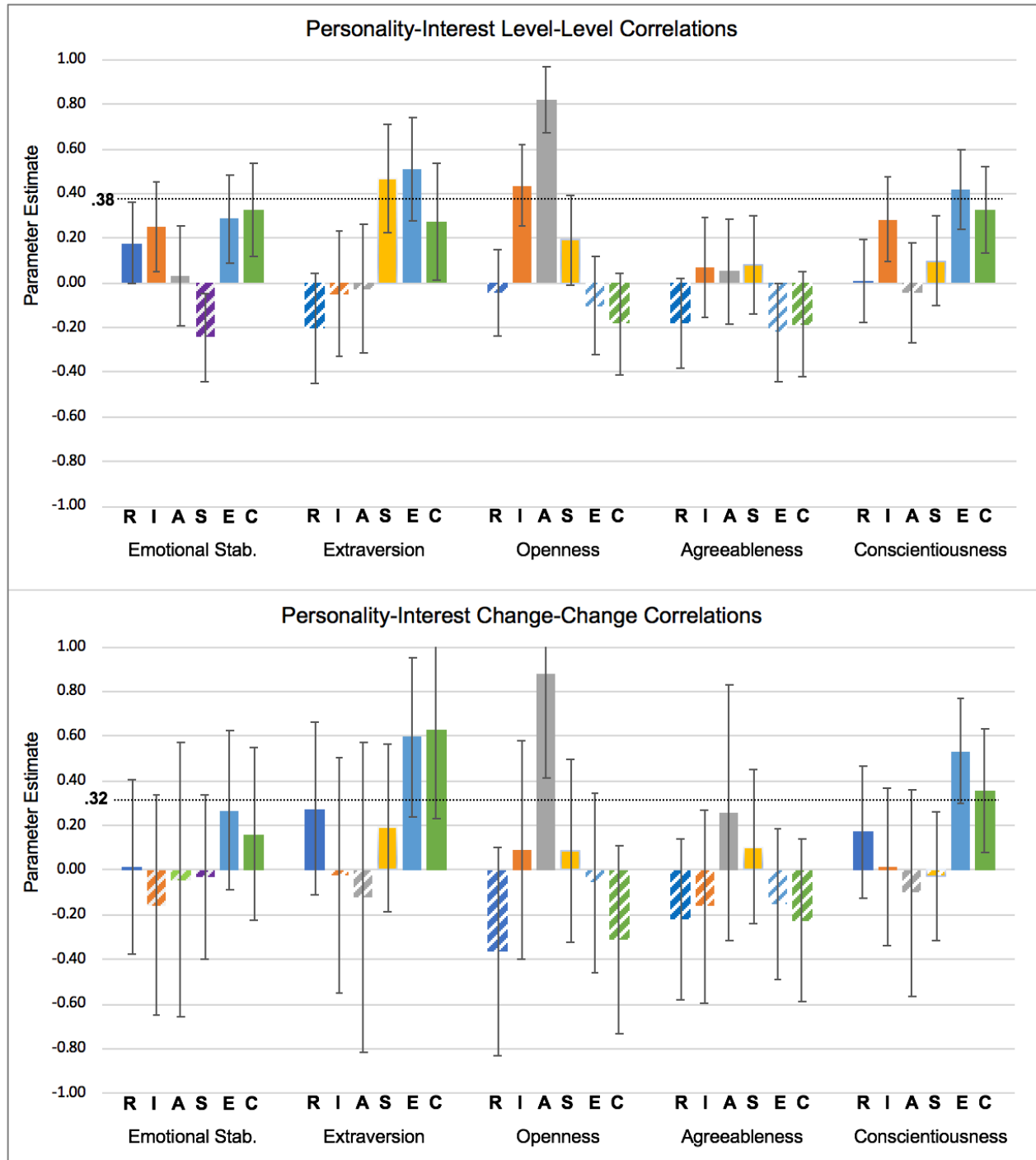


Figure 5. Correlations among intercepts (top) and slopes (bottom) in personality and vocational interests. Horizontal dotted lines indicate correlations among general factors, which were used as a comparison point for the specific pairings. Gradient fill indicates negative correlation. Error bars represent 95% confidence intervals. R = Realistic; I = Investigative; A = Artistic; S = Social; E = Enterprising; C = Conventional.